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TECHNICAL REPORT

72-63-FL

CONSUMER PREFERENCE AND COOKING YIELDS OF THREE AND FIVE POUND PORK SPARERIBS SERVED WITH AND WITHOUT RIB BONES

by

Dexter R. Bellis

John L. Secrist

and

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ABSTRACT

The overall consumer acceptance of three pound and five pound spareribs was not significantly different. When considering tenderness alone, however, the three pound spareribs were considered significantly (5% level) more tender than the five pound spareribs. The acceptance differences among anatomical positions within three and five pound spareribs were found to be insignificant. It is interesting to note that when the rib bones are removed from the spareribs prior to serving, the sensory scores tend to be higher than the sensory scores of the spareribs served with the bones in the customary manner. Boneless yield of cooked spareribs was 46.6 percent for the three pound spareribs and 42.8 percent for the five pound spareribs. Total cooking losses for three and five pound spareribs were 25.5 and 31.1 percent respectively. Fat drip loss of cooked spareribs was 0.6 percent higher for the five pound spareribs. Bone yield was 1.8 percent greater for the three pound spareribs.

The results of this study indicate that military interest in the procurement of pork spareribs weighing three to five pounds should be based primarily on economic and availability considerations.

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Acceptability	7					
Spareribs	9					
Taste tests	8					
Military feeding	4					

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FOREWORD

The Military Services presently serve pork spareribs weighing three pounds or less in their dining facilities. This weight range is the most commonly sold commercially in the retail trade. It provides a satisfactory means for obtaining portion control due to the relative uniform shape and smallness of the rib bones. Four ribs per military man is a most satisfactory serving size.

At the request of the Defense Personnel Support Center, the subsistence procurement arm for the Military Services, this study was made to determine whether spareribs weighing more than three pounds would be as acceptable in military food service as those presently being served. Spareribs weighing in the range two pounds to eight pounds were evaluated in terms of both consumer acceptance and edible yield.

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ABSTRACT

The overall consumer acceptance of three pound and five pound spareribs was not significantly different. When considering tenderness alone, however, the three pound spareribs were considered significantly (5% level) more tender than the five pound spareribs. The acceptance differences among anatomical positions within three and five pound spareribs were found to be insignificant. It is interesting to note that when the rib bones are removed from the spareribs prior to serving, that the sensory scores tend to be higher than the sensory scores of the spareribs served with the bones in the customary manner. Boneless yield of cooked spareribs was 46.6 percent for the three pound spareribs and 42.8 percent for the five pound spareribs. Total cooking losses for three and five pound spareribs were 25.5 and 31.1 percent respectively. Fat drip loss of cooked spareribs was 0.6 percent larger for the five pound spareribs. Bone yield was 1.8 percent greater for the three pound spareribs.

The results of this study indicate that military interest in the procurement of pork spareribs weighing three to five pounds should be based primarily on economic and availability considerations.

INTRODUCTION

The military services presently serve pork spareribs weighing three pounds or less in their dining facilities. This weight has provided an acceptable menu item from both the preparation and consumption standpoints. The continued reliance on this weight range for spareribs could result in limitations in terms of availability and cost. If heavier weight spareribs, on the other hand, prove to be acceptable for troop feeding, the effect would, in all probability, be to reduce raw material costs by providing a broader supply base. This study was undertaken at the request of the Defense Personnel Support Center to determine consumer acceptance, edible yield and cooking losses of three and five pound spareribs. Additional meat yield and cooking loss information was obtained from spareribs in the weight range two to eight pounds.

The effects of physiochemical and processing variables on the eating qualities of different skeletal muscles from different species of meat animals have been the subject of extensive study. However, the major muscles of the wholesale spareribs (external and internal intercostal muscles) have received limited study.

Hammond et al. (1932), McMeekan (1940 a,b) and Carpenter et al. (1963) reported that older animals produced muscle fibers of larger diameter. With an increase in the muscle fiber diameter of pork, Carpenter et al. (1963) observed a decrease in the tenderness of the cooked longissimus dorsi. Porcine tenderness was found by Kauffman et al. (1964) to decrease as the age of animals increased from 132 to 282 days. Palmer (1963) reported that age accounted for only 4 percent of the variation in the tenderness of cattle ranging between 5 and 99 months of age. Alsmeyer et al. (1959) found that chronological age and tenderness were positively correlated. Ziegler (1958) wrote that as carcass weight increased from 139 to 197 pounds, the percent of edible meat from spareribs increased. Usborne et al. (1968) found no significant difference in tenderness of the longissimus dorsi muscle as the live weight of hogs increased from 73 kg. to 127 kg. Flavor, juiciness, and overall acceptance showed higher panel scores for this muscle from the lighter weight hogs. Tuomy et al. (1966) reported that the longissimus dorsi muscle from pork loins in weight ranges twelve pounds and down to twenty pounds and up showed less tenderness as the loin weight increased. Flavor differences were not observed in the different weight loins. Tenderness variations found within different porcine muscles have been reported by Weir (1953), Batcher et al. (1960), Rupnow et al. (1961) and Alsmeyer et al. (1965). Saffle et al. (1959) and Murphy et al. (1961) concluded that drip loss was directly related to backfat thickness. Field et al. (1961) reported a significantly lower cooking loss from loins of lighter weight hogs which was attributed to less rendering of fat.

MATERIALS AND METHODS

A preliminary study was made to determine whether variations in tenderness, flavor and odor exist within the wholesale spareribs due to differences in anatomical location. For this work ten three pound and ten five pound ($\pm \frac{1}{4}$ pound) frozen spareribs were utilized. The spareribs were thawed at 50°F. for 48 hours. The spareribs were then trimmed free of surface fat exceeding $\frac{1}{4}$ inch, and the dense connective tissue (Centrum tendineus) was separated from the fleshy diaphragm muscle (Pars costalis). All spareribs were divided into anterior, medial and posterior portions (Figure 1). The anterior portion was separated from the medial portion between the third and fourth ribs while the medial and posterior portions were divided between the seventh and eighth ribs. The anatomical separations of the three portions were cut with reference to the number of rib bones in the wholesale spareribs. Each portion was identified as to its original spareribs weight and anatomical position. The spareribs portions were braised in "square-head" cooking pans measuring approximately 20 inches x 16 inches x 6 inches to which one quart of water was added. Portions were braised at 375°F. to an internal temperature of 175°F.

The three anatomical portions of both three and five pound spareribs were cut into one rib servings for preference scoring. Seventeen panelists, using the hedonic scale outlined by Peryam et al. (1957), evaluated tenderness, flavor and odor for each anatomical location within each weight group.

A second study was made to investigate consumer preference, cooking yield, and cooking loss differences between three and five pound spareribs. The spareribs were thawed, trimmed and cooked in the same manner reported in the preliminary study, except that the spareribs were not cut into anatomical portions. Thirty-two three pound and sixteen five pound spareribs were cooked in all. At the end of the braising period, weights of the cooked spareribs, fat drippings, and bone from each weight group were separately measured and recorded. Since the visual effect of bone present in the larger spareribs was suspected to be a psychological influence on the preference evaluation, the spareribs meat of each weight category was sensory evaluated with and without the rib and sternum bones. When served to the taste panel with bone-in, the spareribs were divided into the customary serving weight (12 ounces) recommended by the U.S. Army-Air Force Master Menu Board. This amounted to a 4 rib serving for the three pound spareribs and a 2 rib serving for the five pound spareribs. For an evaluation of the boneless three and five pound spareribs meat, 2 ounce portions were served to each panelist. The taste panel consisted of 30 members. Bone-in three and five pound spareribs were evaluated on one day while the boneless spareribs were evaluated on the following day. Product characteristics which panel members evaluated were: (1) tenderness, (2) flavor, (3) odor and (4)overall preference of the product. Preference data were analyzed by a test of significance using the t-test as discussed by Snedecor (1956).

Cooking yields and losses were more extensively investigated by a third study. For this study forty-eight spareribs ranging in raw weight from two to eight pounds were cooked. Again, the spareribs were thawed, trimmed and cooked in the same manner reported in the preliminary study. Prior to cooking, the raw weight of each sparerib was recorded. Aluminum foil containers, each holding one sparerib, were placed in "square head" pans and braised at an oven temperature of 375°F. Upon reaching an internal temperature of 170°F., the spareribs were removed from the oven and weighed. Cooked spareribs were then cooled to 40°F. and the drip loss and bone weights were recorded. All weights were made to the nearest whole gram.

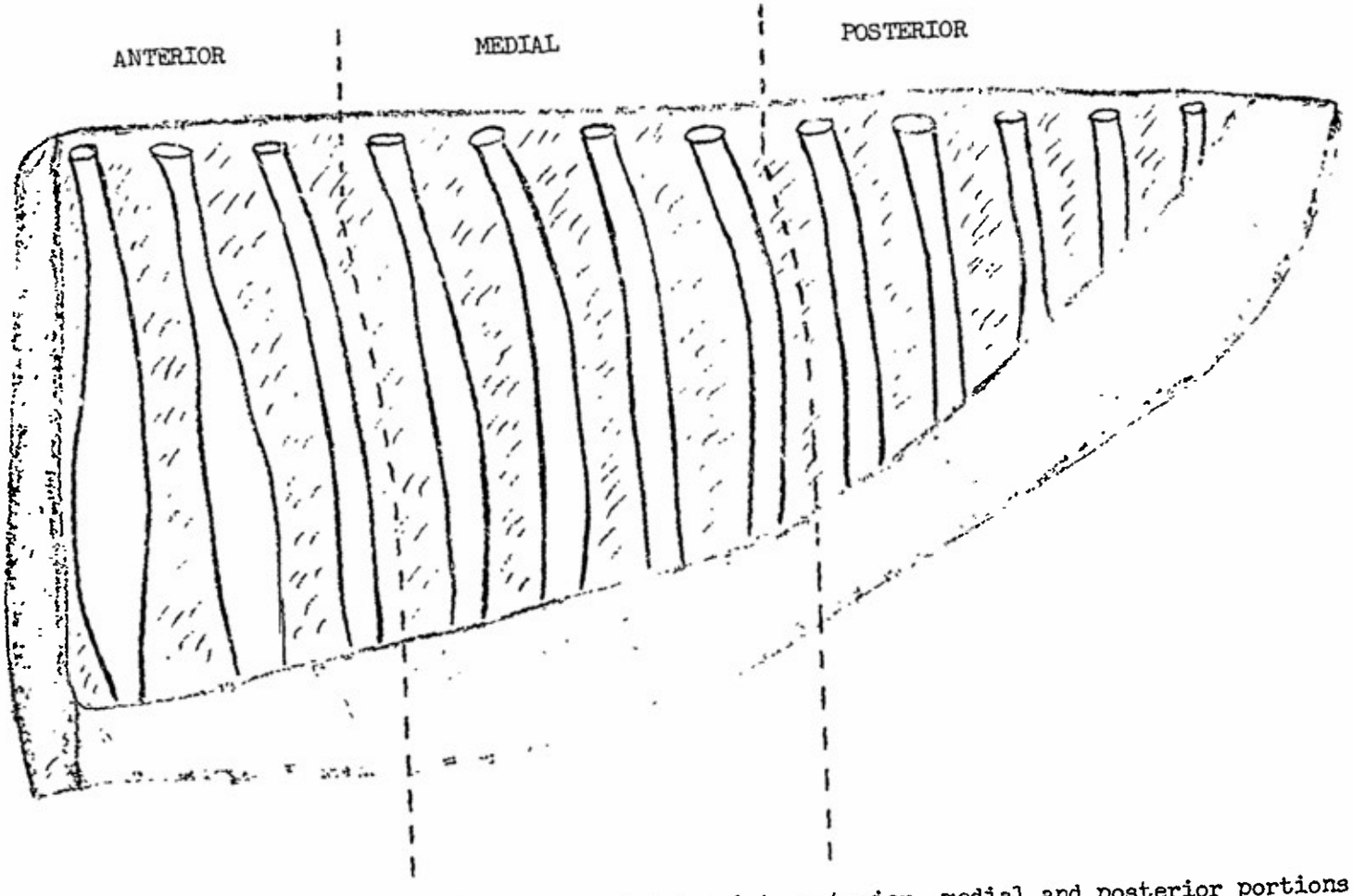

Fig. 1. Method of sectioning wholesale spareribs into anterior, medial and posterior portions.

RESULTS AND DISCUSSION

The results of the preliminary study containing preferences scores of seventeen panelists are presented in Table 1. An analysis of this data, from the three and five pound spareribs indicated no significant difference for tenderness, flavor and odor existed between the different anatomical locations. Based on these results, the entire spareribs was utilized in the second study.

Table 2 contains the mean preference scores from the second study. The overall consumer preference of three pound and five pound spareribs was not significantly different. However, the tenderness scores of the three pound spareribs were significantly (5% level) greater than the tenderness scores of the five pound spareribs. Flavor and odor scores were not significantly different. All mean preference scores were above the minimum acceptable level of 6.0, except for the tenderness scores of five pound spareribs which was borderlined at 5.8 and 6.1. During the study, the investigators noted that the rib bones of the five pound spareribs were much larger in size than those of the three pound spareribs and were thought to be objectionable from an aesthetic standpoint. Thus the spareribs meat was presented to panelists with and without rib bone. The panel results show that the sensory scores tend to be higher when the rib bones are removed before serving. This is academic at this time however, since spareribs are customarily served with rib bones.

Presented in Table 3 are the cooking yields and losses of three and five pound spareribs. The yield of edible meat from the cooked three pound spareribs was 3.8% greater than that from the five pound spareribs. The bone yield was 1.8% greater for the three pound spareribs. These findings agree with those of Cuthbertson et al. (1962) who found that the percent of total carcass weight represented by the skeleton decreased as the animal weight increased.

The total cooking losses were 5.6% greater for the five pound spareribs, although the fat drip loss was only 0.6 percent greater for the five pound spareribs. The closeness of the fat loss comparative results may be explained by the fact that both weight groups of spareribs were trimmed to the same $\frac{1}{4}$ inch maximum fat thickness and the greater losses were attributed to moisture losses during cooking and cooling of the spareribs.

In Table 4 and Figures 1-4 inclusive, are presented the relationships between the raw, bone-in weights of spareribs in the range two to eight pounds and the weights of the spareribs cooked to 170°F., bone weights, fat cooking loss weights and total cooking loss weights respectively. The correlation cooefficient (r) of each of the above relationships was found to be highly significant at the 1 percent level of confidence. This indicates

that reasonably accurate estimates of the dependent variables can be made when the weights of the raw, bone-in spareribs are known.

SUMMARY

The meat from three pound spareribs was found to be significantly ($p < 0.05$) more tender than that of five pound spareribs. This was the case whether the spareribs meat was served with or without the ribs attached.

On the other hand, the overall consumer preference of the three and five pound bone-in spareribs was not significantly different. Neither were the flavor or the odor scores significantly different.

In each of the three and five pound sparerib weight groups, there were no significant differences in tenderness, odor or flavor attributable to any particular sparerib area from which the samples were taken.

Edible meat yield from cooked three pound spareribs was 3.8% larger than that of five pound spareribs. The three pound spareribs also had 1.8% greater bone yield. Five pound spareribs showed a 0.6% greater fat cooking loss and a 5.6% greater total cooking loss. Regression equations and correlation coefficients were calculated comparing raw weight of spareribs with cooked weight, bone weight, fat cooking losses and total cooking losses. Correlation coefficients were 0.99, 0.95, 0.72 and 0.86 respectively ($p < 0.01$).

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Table 1. Mean tenderness, flavor and odor scores obtained from 3 and 5 pound spareribs from three different anatomical locations. 1/

Spareribs Weight	Anatomical Location	Tenderness	Flavor	Odor
3 lbs.	Anterior	7.5	7.2	7.3
	Medial	7.4	6.9	7.0
	Posterior	7.4	7.2	7.1
5 lbs.	Anterior	6.0	6.6	6.6
	Medial	5.9	6.8	6.7
	Posterior	5.8	6.9	6.9

1/ 9 point hedonic scale; Peryam et al (1957).

Table 2. Mean tenderness, flavor, odor and overall preference scores of 3 and 5 pound spareribs served with and without rib bones. 1/

Spareribs Weight		Tenderness	Flavor	Odor	Overall Preference
3 lbs.	with rib bones	6.7*	6.7	6.6	6.4
	without rib bones	7.3*	7.1	6.9	7.2*
5 lbs.	with rib bones	5.8	7.0	6.6	6.5
	without rib bones	6.1	7.0	7.0	6.7

1/ 9 point hedonic scale; Peryam et al (1957).

* ($p > 0.05$)

Table 3. Cooking yields and losses of 3 and 5 pound pork spareribs.

Spareribs Weight	Yield of Edible Cooked Meat (%)	Bone Yield (%)	Total Yield of Cooked Spareribs Bone-in (%)	Fat Drip Loss	Total Cooking Loss (%)
3 lbs.	46.6	27.9	74.5	7.0	25.5
5 lbs.	42.8	26.1	68.9	7.6	31.1

Table 4. Raw Weight (lbs.) versus (a) Cooked Weight (lbs.) at 170°F.
(b) Bone Weight (lbs.)
(c) Fat Cooking Loss (lbs.)
(d) Total Cooking Loss (lbs.)

Pork Spareribs

n	Raw Weight (lb.)	Cooked Weight (lb.)	Bone Weight (lb.)	Fat Cooking Loss (lb.)	Total Cooking Loss (lb.)
1	2.00	1.10	0.45	0.150	0.150
2	2.25	1.25	0.63	0.140	0.145
3	2.32	1.36	0.50	0.150	0.150
4	2.38	1.27	0.55	0.150	0.150
5	2.38	1.43	0.55	0.203	0.203
6	2.47	1.47	0.55	0.178	0.197
7	2.53	1.58	0.55	0.140	0.145
8	2.63	1.70	0.75	0.202	0.205
9	2.70	1.70	0.60	0.208	0.210
10	2.75	1.75	0.52	0.197	0.198
11	2.75	1.78	0.82	0.224	0.224
12	2.82	1.87	0.80	0.270	0.270
13	2.85	1.83	0.67	0.223	0.230
14	3.10	2.28	0.70	0.160	0.160
15	3.13	2.16	0.65	0.250	0.250
16	3.17	2.37	0.87	0.100	0.100
17	3.25	2.34	0.85	0.370	0.370
18	3.35	2.36	0.78	0.280	0.280
19	3.40	2.56	0.72	0.170	0.174
20	3.40	2.56	0.87	0.220	0.225
21	3.42	2.35	0.77	0.250	0.250
22	3.45	2.47	0.80	0.180	0.180
23	3.55	2.53	0.90	0.262	0.265
24	3.63	2.77	0.89	0.138	0.150
25	3.63	2.82	0.80	0.238	0.240
26	4.03	2.84	1.08	0.437	0.440
27	4.17	2.90	0.95	0.410	0.410
28	4.26	2.77	1.18	0.320	0.395
29	4.26	3.43	1.25	0.448	0.470
30	4.50	3.16	1.03	0.360	0.452
31	4.60	3.00	1.10	0.480	0.480
32	4.92	3.35	1.22	0.460	0.700
33	5.11	3.77	1.36	0.398	0.600
34	5.25	3.72	1.25	0.438	0.650
35	5.42	3.82	1.28	0.300	0.500
36	5.45	3.80	1.28	0.450	0.600
37	5.54	3.73	1.26	0.620	0.830
38	5.63	4.32	1.18	0.370	0.450
39	5.70	4.37	1.25	0.130	0.350
40	5.75	4.75	1.60	0.252	0.500
41	5.80	3.97	1.25	0.598	0.670
42	6.25	4.90	1.54	0.300	0.500
43	6.40	5.03	1.10	0.400	0.425
44	6.75	5.17	1.55	0.400	0.700
45	6.78	5.13	1.92	0.391	0.400
46	7.38	5.97	1.78	0.397	0.597
47	7.63	6.00	1.75	0.458	0.750
48	7.76	5.54	1.82	0.514	0.820

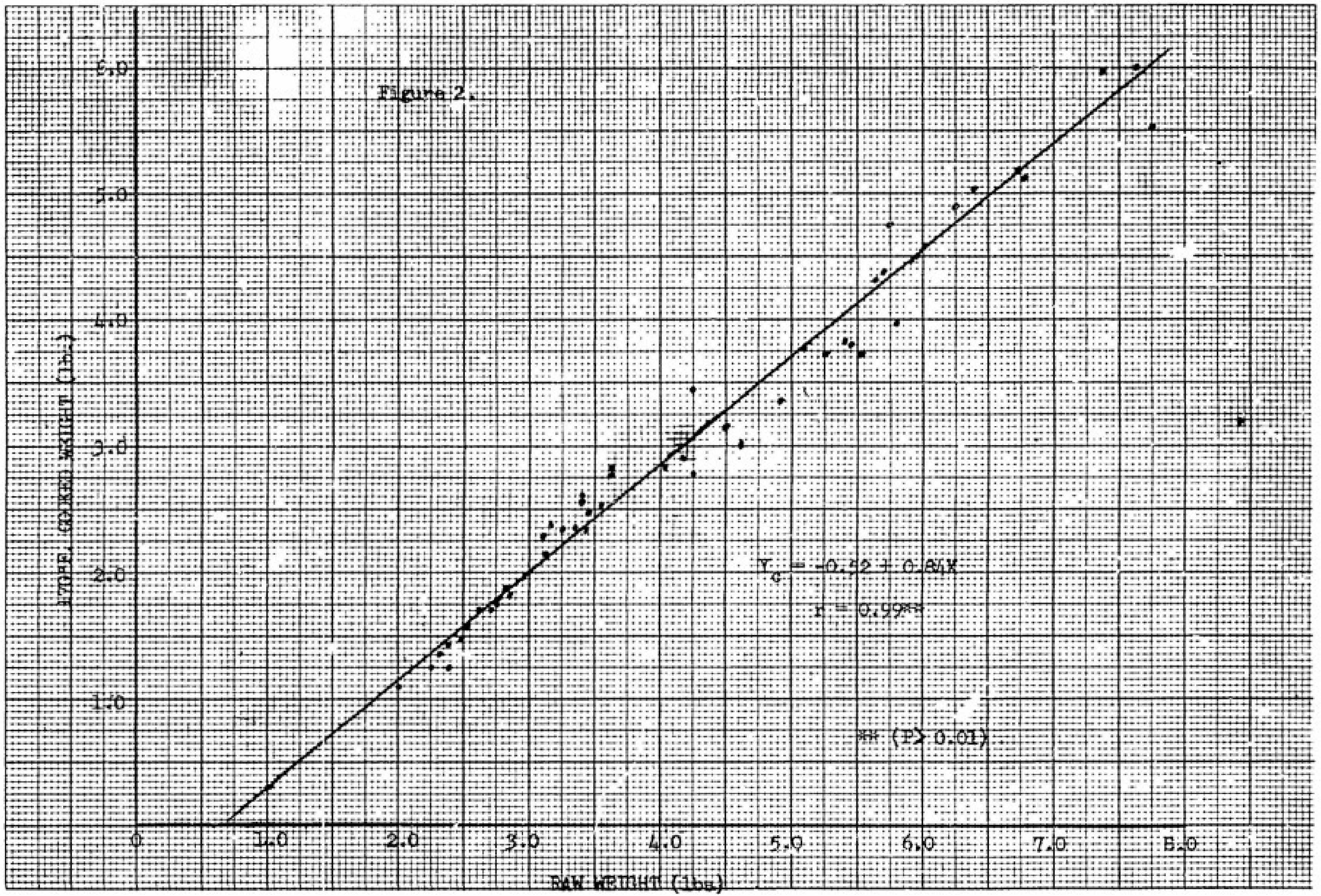

170°F. COOKED WEIGHT (lb.)
6.0
5.0
4.0
3.0
2.0
1.0
0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
RAW WEIGHT (lbs)
$Y_c = -0.52 + 0.84X$
$r = 0.99^{**}$
** (P> 0.01)

Figure 2.

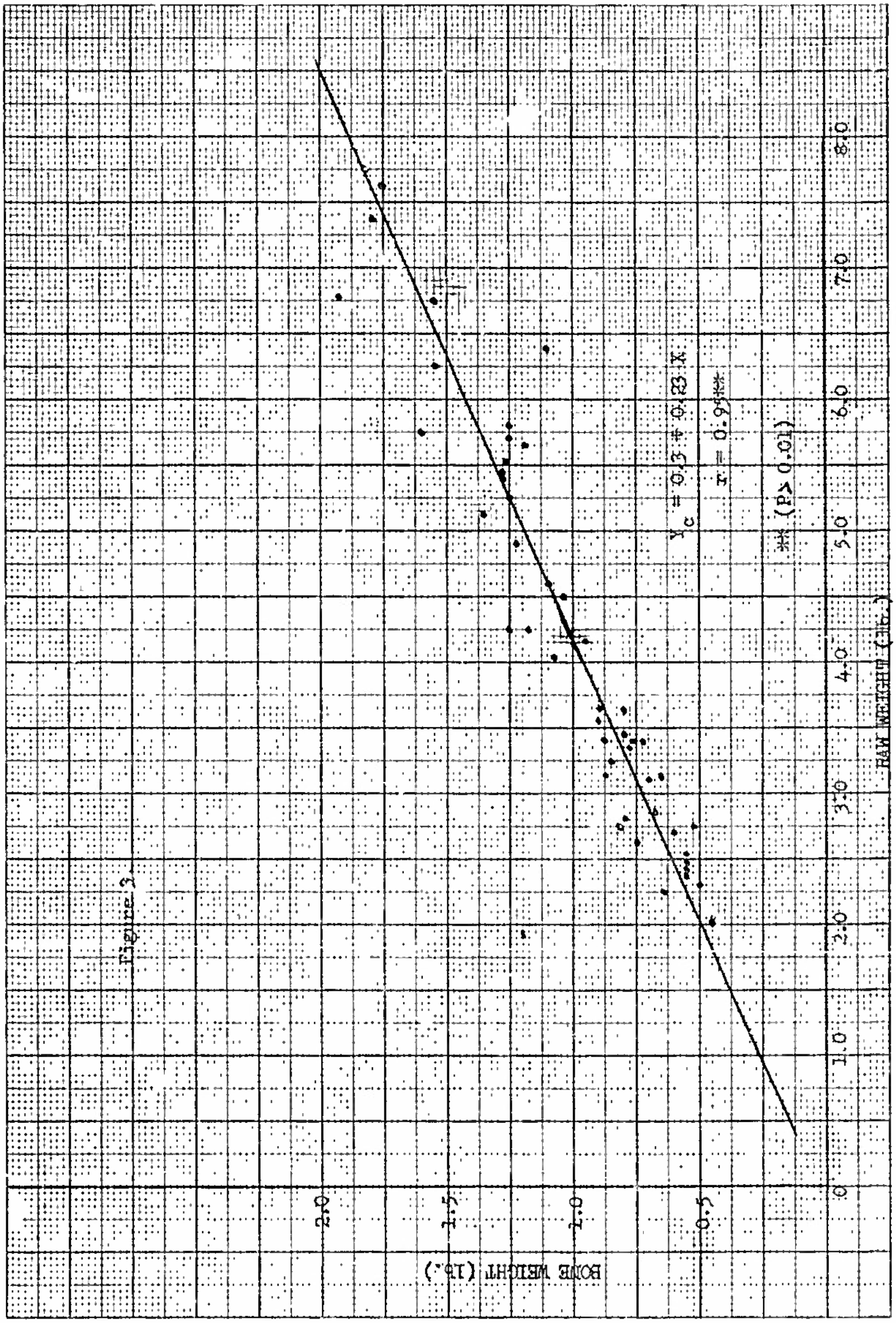


Figure 3
$Y_c = 0.3 + 0.23\,X$
r = 0.9**
** (P> 0.01)
BONE WEIGHT (lb.)
RAW WEIGHT (lb.)
0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
0.5
1.0
1.5
2.0

Figure 4.

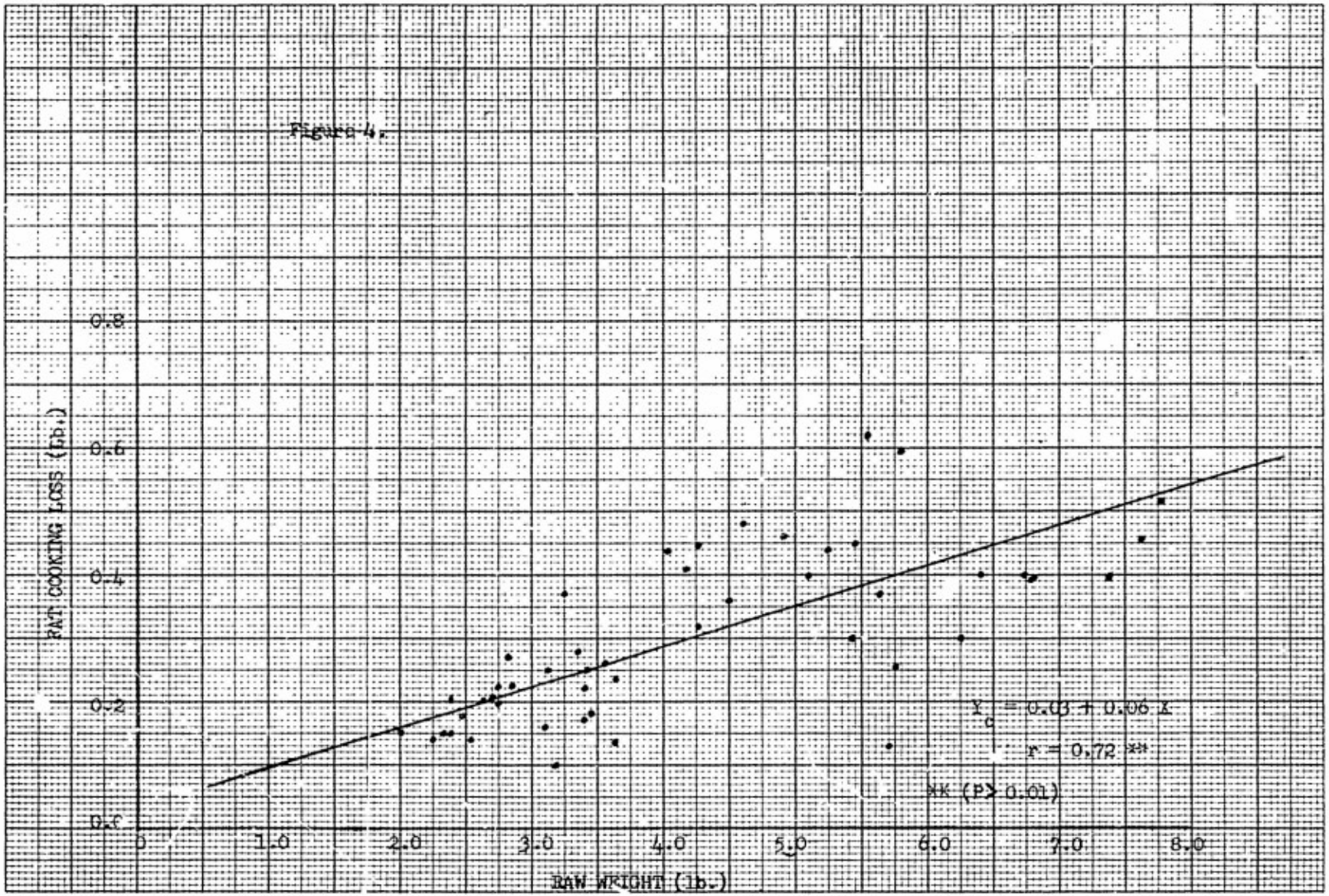
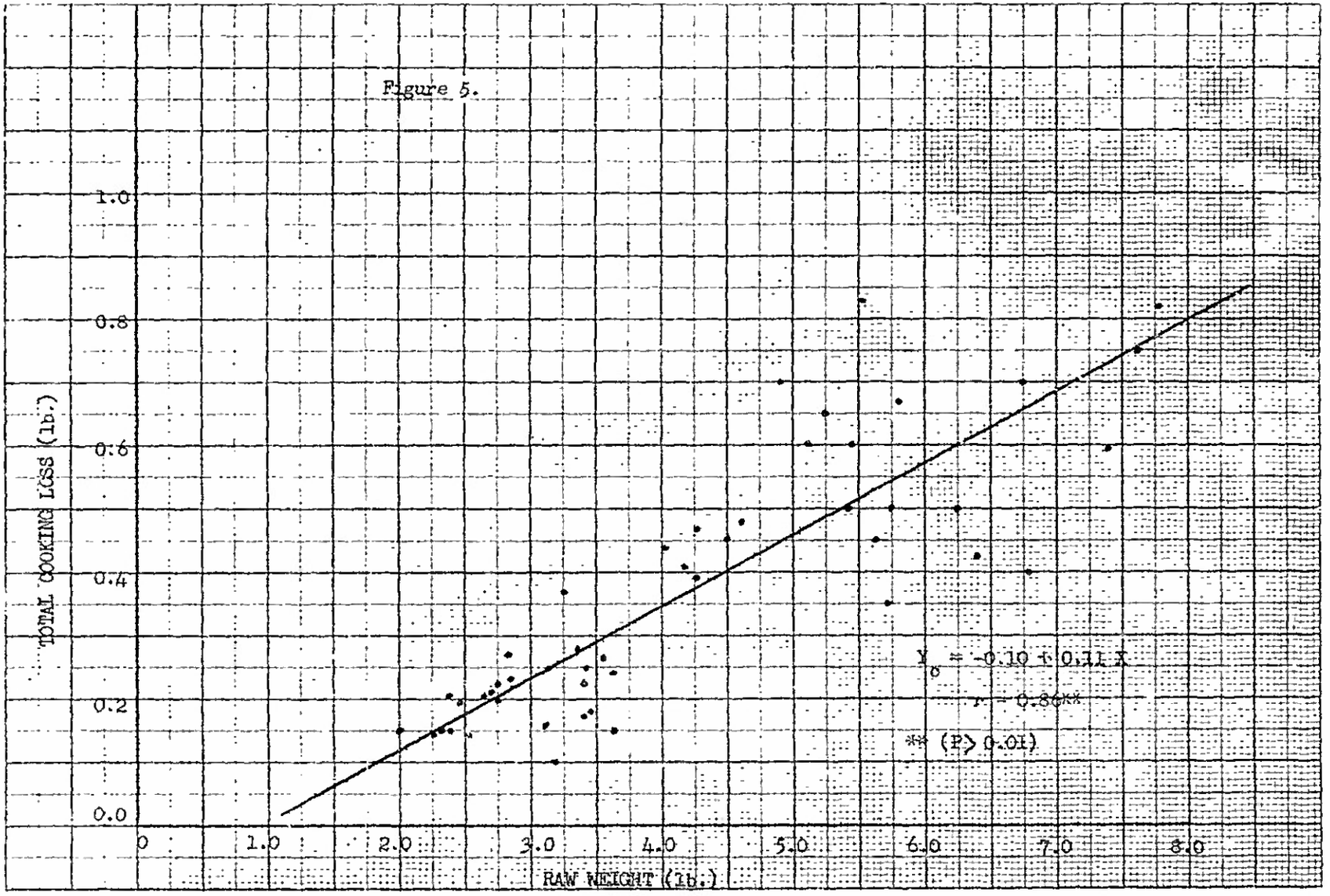

FAT COOKING LOSS (lb.)
0.8
0.6
0.4
0.2
0.0
0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
RAW WEIGHT (lb.)
$Y_c = 0.03 + 0.06\ x$
$r = 0.72$ **
** (P> 0.01)

Figure 5.


TOTAL COOKING LOSS (lb.)
1.0
0.8
0.6
0.4
0.2
0.0
0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
RAW WEIGHT (lb.)
$Y_c = -0.10 + 0.11 X$
$r = 0.86^{**}$
** (P> 0.01)